BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: ATM Vibration and Acoustics Measurements - Case 620

DATE: December 27, 1967

FROM: S. H. Levine

ABSTRACT

This memorandum discusses MSFC's current requirements for the acquisition of vibration and acoustics measurements during the launch phase of the AAP-4 mission.

In addition, this memorandum reviews MSFC's consideration of obtaining these measurements during docking of the LM/ATM to the orbiting MDA/AM/OWS and discusses the disadvantages of the approaches currently being considered.

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MEMORANDUM FOR FILE

This memorandum discusses the present planning for ATM data acquisition during the launch phase of the AAP-4 mission.

The acquisition of vibration and acoustics data during the launch phase is necessary in order to permit post flight analysis of the actual flight environment and to determine its effect on ATM subsystem performance.

Present ATM planning documentation identifies the following measurement requirements (Ref. 1) during the launch phase:

		No. Measurements
1.	Solar Panel Acceleration (50-750 cps)	3
2.	Acoustics (50-3000 cps)	2
3.	Vibration (50-3000 cps)	35
	Total ATM launch measurements -	40

The current AAP program baseline (Ref. 2) provides that hardware will be carried in the AAP-4 Instrument Unit (IU), which will perform the task of transmitting these real time ATM measurements during launch phase of AAP-4 flight. Figure 1 identifies the hardware which currently constitutes the MSFC hardware baseline for this function. Selection of the F-2 Telemetry System (FM/FM telemetry) and the S-1 Telemetry System (Single Sideband/FM telemetry) along with the necessary telemetry support hardware, identified below, was predicated on the basis of the following rationale:

1. This hardware was previously qualified for and will have been flight tested on Apollo SA-201 thrcugh SA-204 and on SA-501 through SA-503 launch vehicles by the time the ATM is flown.

2. The operational IU currently has provisions for mounting and cooling these units (brackets, cold plates, etc.) and supplying sufficient power for the operation of these units.

3. This system is compatible with the existing IU antenna system.

4. Utilization of spares, previously allocated for SA-501 and SA-502, for this ATM function is being considered. On this basis, no additional procurement will be necessary to satisfy the ATM needs in this area.

The weight breakdown for the MSFC baseline configuration is as follows:

		Weight (#)
1.	F-2 RF Transmitter Assembly	19.3
2.	F-2 Telemeter Assembly	14.0
3.	Measurement Racks (2) @ 21.4#	42.8
4.	S-1 RF Transmitter Assembly	19.3
5.	S-1 Telemeter Assembly	17.5
6.	Model 245 Slow Speed Multiplexer	12.5
7.	Cabling and Connectors	25.0
	Total Weight	150.4#

Using this configuration in conjunction with existing operational IU antennas, 12 continuous FM/FM measurements and 28 wideband Single Sideband/FM measurements will be transmitted for post flight evaluation.

Recent discussions with MSFC have revealed growing concern over the induced environment during docking of the LM/ATM to the MDA. Consideration is presently being given towards acquiring loads and vibration data during this phase of the AAP-4 mission. MSFC is considering moving the telemetry equipment, previously discussed, from the IU to the ATM in order to permit data acquisition after separation of the LM/ATM from the AAP-4 launch vehicle (i.e., during docking to the MDA).

Since the ATM active cooling system is located on the Experiment Package, the telemetry units, previously identified, would have to be mounted on the Experiment Package where cold plates could be made available for cooling them. Location of these units in or on the ATM Experiment Package could present the following problems:

1. The need for additional wiring across the ATM gimbals to transducers on the rack and to power sources on the rack.

2. The requirement for additional ATM power during launch and docking phases. Currently, the only power available on the ATM prior to docking of the LM/ATM to the MDA (after which solar array deployment occurs) comes from Silver-Zinc primary (non-rechargeable) batteries (Ref. 5) which are specifically used for ATM Rack thermal control during this period. All other ATM systems, including the ATM solar array rechargeable battery electrical power system, in the current planning, will not be energized until after deployment of the ATM solar array. The requirement for the ATM coolant system to be active during the docking phase of the mission would probably require either a growth in the primary batteries or activation of the Nickel-Cadmium rechargeable batteries prior to solar array deployment.

3. The possible interference with experiment thermal control by locating this telemetry equipment between the experiments and the thermal sink (canister wall).

4. The addition of new antennas to permit transmission to the MSFN prior to solar array deployment or a scheme to permit utilization of existing ATM antennas (presently located on the extremities of the solar wings).

5. The possible impact on design of the ATM gimbal mounts, gimbal torquers, and roll positioning devices. Gimbal mounts are currently being designed by Perkin-Elmer for an Experiment Package weight of 5000 ±10% pounds. The current weight estimate of the Experiment Package is approximately 5400 pounds. Utilizing this telemetry approach would leave no margin for design contingencies.

6. The addition of equipment to the canister would reduce the available space between experiments and would therefore restrict factory and MSOB activities within the experiment package.

If the alternate MSFC approach of mounting the required telemetry equipment, for this function, on the ATM Rack is adopted, either:

1. The Uprated Saturn I hardware would have to be significantly modified to operate in a passively controlled thermal environment or

2. the utilization of other hardware would have to be considered. This, of course, would not permit MSFC to benefit from its experience with Saturn hardware, vendors, etc., and would necessitate additional effort on contracts, specifications, etc.

At best, either ATM Rack mounted system would require some hardware development and qualification work and would carry along with it the power and antenna complications previously cited for the Experiment Package mounted system. Incorporation of these units on the ATM Rack does not appear to result in either a space problem or an accessibility problem, since the rack has recently been lengthened and the electrical power system's battery - charger - regulator units have been decreased in number (i.e., more space is available).

S. H. Levine

1024-SHL-sew

Attachments

REFERENCES

1. 50M12711 - Instrumentation Program and Components List, ATM Rack (ATM#1) - George C. Marshall Space Flight Center - May 12, 1967 (including ECR AAUE 480-1 and 480-2).

2. Baseline Configuration Definition - AAP-1A through 5 - December 6, 1967.

3. MSFC III-5-509-1 Technical Manual - Saturn IB/V Instrumentation System Description (S-IU-202 thru 204/501 thru 503) - June 1, 1966.

4. MSFC III-5-509-4 Technical Manual - Saturn IB/V Instrumentation Unit System Description and Component Data - March 1, 1966.

5. A 50M72900(-) Equipment List and Associated Technical Data - Apollo Telescope Mount, ATM-A (Preliminary)-December 12, 1967.

6. Saturn V Technical Checklist - Revision 12 - October 1, 1967.

7. Saturn IB Technical Checklist - Revision 14 - August 1, 1967.

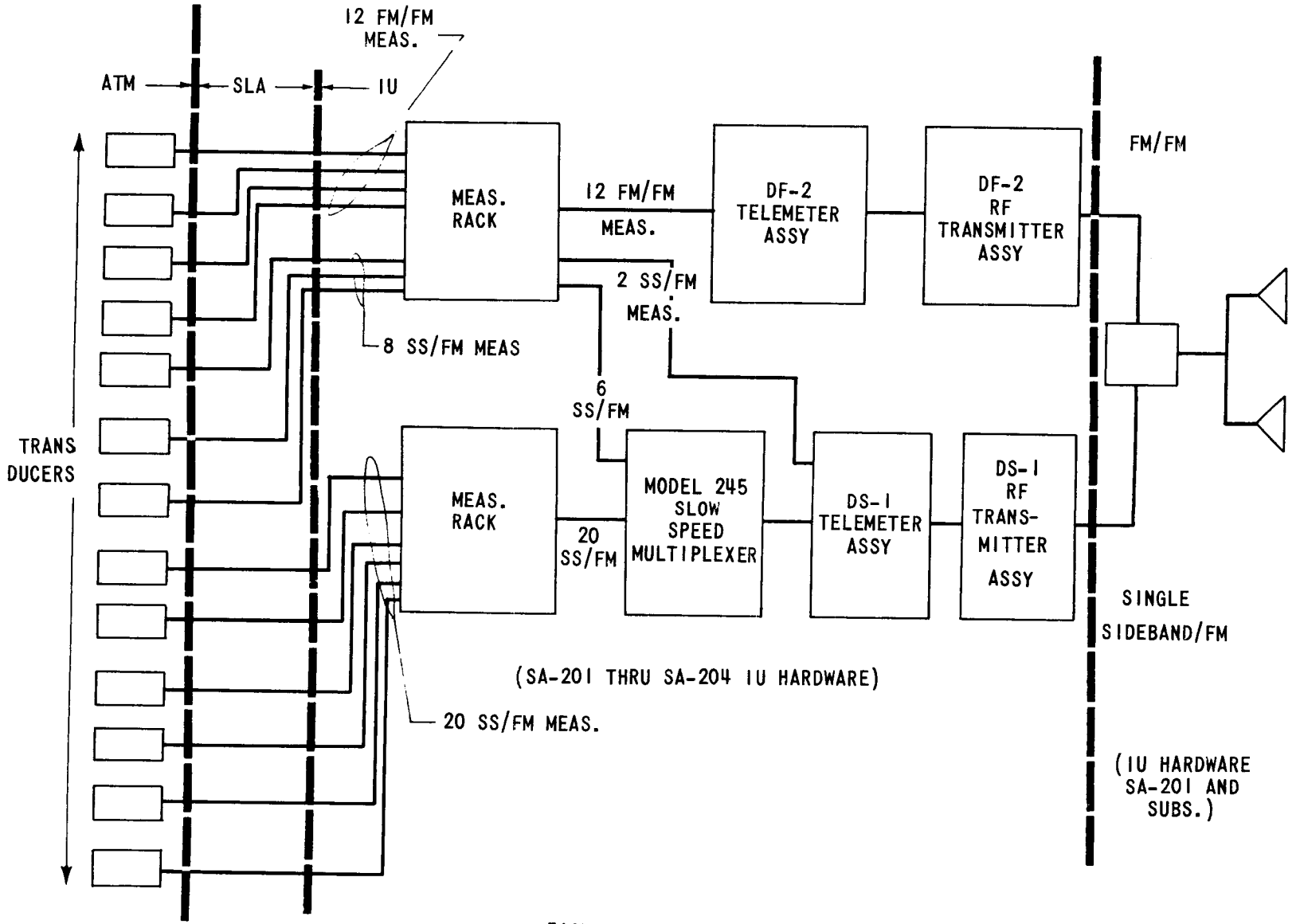

FIGURE I - ATM LAUNCH TELEMETRY

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